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School-based brief psycho-educational intervention to raise adolescent cancer awareness and address barriers to medical help-seeking about cancer: a cluster randomised controlled trial

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Trial registration
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Abstract

Objectives: Raising cancer awareness and addressing barriers to help-seeking may improve early diagnosis. The aim was to assess whether a psycho-educational intervention increased adolescents' cancer awareness and addressed help-seeking barriers.

Methods: This was a cluster randomised controlled trial involving 2173 adolescents in 20 schools. The intervention was a 50-min presentation delivered by a member of Teenage Cancer Trust's (UK charity) education team. Schools were stratified by deprivation and roll size and randomly allocated to intervention/control conditions within these strata. Outcome measures were the number of cancer warning signs and cancer risk factors recognised, help-seeking barriers endorsed and cancer communication. Communication self-efficacy and intervention fidelity were also assessed.

Results: Regression models showed significant differences in the number of cancer warning signs and risk factors recognised between intervention and control groups. In intervention schools, the greatest increases in recognition of cancer warning signs at 6-month follow-up were for unexplained weight loss (from 44.2% to 62.0%) and change in the appearance of a mole (from 46.3% to 70.7%), up by 17.8% and 24.4%, respectively. Greatest increases in recognition of cancer risk factors were for getting sunburnt more than once as a child (from 41.0% to 57.6%) and being overweight (from 42.7% to 55.5%), up by 16.6% and 12.8%, respectively. Regression models showed that adolescents in intervention schools were 2.7 times more likely to discuss cancer at 2-week follow-up compared with the control group. No differences in endorsement of barriers to help-seeking were observed.

Conclusions: School-based brief psycho-educational interventions are easy to deliver, require little resource and improve cancer awareness.

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Background

UK governments aim to improve cancer survival by increasing the proportion of people with early diagnosis [1]. One strategy is raising public cancer awareness [2–5].

There are few cancer awareness interventions for adolescents [6]. Individual-level interventions to improve cancer awareness among adults have small effects [7]. One study found that women who received an intensive intervention (tailored written information, newsletter at 12 months and two telephone counselling sessions) were more likely to give the correct answer to a question about

age-related breast cancer risk compared with those with usual care (32% vs 20%) at 2-year follow-up [8]. However, whether this represents an increase in knowledge is uncertain because baseline assessments were not reported. Another study found that skin cancer knowledge was significantly higher after 6 months among people receiving an interactive computer programme compared with people not receiving the programme [9]. However, mean scores were similar for both groups at baseline and follow-up. Another study found that knowledge of oral cancer was significantly higher after 8 weeks among people receiving a leaflet compared with people not receiving a leaflet [10].

Nonetheless, median scores were similar and increased for both groups.

Interventions informed by the Common Sense Model aim to influence cognitive and emotional representations of cancer, thereby changing help-seeking behaviour [11,12]. Communication is also important because difficulty talking to a doctor is a barrier to seeking medical help about cancer [13]. A determinant of adolescents seeking medical help is their communication with parents about cancer [14]. Interventions may be able to improve adolescent help-seeking behaviour by increasing cancer communication self-efficacy [15,16]. In addition, baseline self-efficacy as well as positive or negative changes in baseline self-efficacy for a specific health behaviour can mediate health outcomes independently and may predict adoption or maintenance of disease management behaviours, including help-seeking [17,18].

The possibility of raising adolescent cancer awareness and addressing barriers to seeking medical help about cancer by a simple school-based brief intervention is tantalising because they are relatively easy to implement and do not require large investments in human resources and materials. Given the potential low cost and ease of implementing brief interventions, a critical question is whether they are effective.

In this paper, we report the results of a cluster randomised controlled trial (RCT) of a school-based brief psycho-educational intervention to raise adolescents' cancer awareness and address barriers to seeking medical help (primary outcomes) and cancer communication.

Methods

Trial design

A cluster RCT was chosen to prevent contamination and selection bias [19]. Clusters were schools. Full details of the trial design are available in the published protocol [20]. There was no deviation from the published protocol after trial commencement.

Participants

All 29 mainstream state high schools in Glasgow were invited by letter to participate; 20 schools (69.0%) were recruited. Three schools informed a researcher that they did not wish to participate, and six schools did not respond to a maximum of three telephone calls. The composition of non-participating schools was not different from participating schools.

The study focused on early adolescence (12/13 years) because it is a key life stage transition. In this age group, 3223 adolescents were on the school register in trial schools. Parents/carers were sent a letter and information sheet about the study, which included a form to be returned to school if they wished to opt their child out of

the study. No parent/carer refused to allow their child to participate. Adolescents were provided with an information sheet about the study when baseline measurements were undertaken and were asked to give written consent to their participation. Two thousand and one hundred seventy-three (67.4%) consented to trial participation and baseline data collection.

Intervention

The intervention [20] was amended from a previously evaluated intervention [6] to place greater emphasis on increasing adolescents' communicative self-efficacy by including role-play and homework and on addressing barriers to seeking help from a doctor by including a short film. Table 1 provides a summary of the intervention following Template for Intervention Description and Replication guidelines [21].

Measures

Outcomes

Primary outcomes were number of (1) cancer warning signs, (2) cancer risk factors recognised and (3) barriers to help-seeking endorsed at 2-week and 6-month follow-ups. These outcomes were assessed using the Cancer Awareness Measure [22], which has been used in previous studies of adolescent cancer awareness [4].

Recognition of signs and symptoms of cancer was assessed through a nine-item question. The question was phrased as 'The following may or may not be warning signs for cancer. For example, if you think that an unexplained lump or swelling could be a sign of cancer tick the Yes box, if you do not think it is tick the No box and if you don't know tick the don't know box. We are interested in your opinion'. This was followed by a list of nine warning signs. Responses were dichotomised for analysis (i.e. 'Yes' versus 'No'/'Don't know') with Yes responses summed to derive a total recognition score.

Recognition of cancer risk factors was assessed through an 11-item question. The question asked: 'These are the things that can increase a person's chance of developing cancer. How much do you agree that each of these can increase a person's chance of developing cancer?'. Eleven cancer risk factors were listed. Responses were recorded on a 5-point Likert scale that ranged from 'strongly disagree' to 'strongly agree'. Responses were dichotomised for analysis (i.e. 'strongly agree'/'agree' versus 'not sure'/'disagree'/'strongly disagree') with the number of 'strongly agree'/'agree' responses summed to derive a risk factor score.

Barriers to help-seeking were assessed with 11 items, including four emotional barriers (e.g. 'I would be worried what the doctor might find'), three practical

barriers (e.g. 'I would too busy to make time to go to the doctor') and three service barriers (e.g. 'I would be worried about wasting the doctor's time'). Response options were 'Yes often', 'Yes sometimes' and 'No', which for analysis were re-categorised as 'Yes' or 'No'. Summation of 'Yes' responses was used to derive a total score.

A secondary outcome was cancer communication assessed using a question adapted from our pilot study [6]. Adolescents were asked if they have spoken to their mother, father or someone else about cancer in the previous 2 weeks. Response options were 'Yes' and 'No'. Communication self-efficacy was assessed by six questions (e.g. 'I will be able to ask my parents/carers for advice about

Table 1. Template for Intervention Description and Replication checklist

Item	Description	Intervention
Brief name		
1. Title	Adolescent Cancer Education	
Why		
2. Theory	Social cognitive theory was used to modify an existing and previously evaluated school-based cancer awareness intervention to increase adolescents' communicative self-efficacy through the following change techniques:	
	Information source	Change techniques
	1. Performance attainments: mastering the skill of cancer communication	Homework to enhance family communication about cancer
	2. Vicarious experience: exposure to young people of a similar age who have mastered the task of cancer communication	Video clips of young people talking about cancer
	3. Verbal persuasion: exposure to an empathetic and knowledgeable educator	Video clips explaining why it is good to talk to parents about your health
	4. Physiological and affective states	Video clips addressing worries and anxieties associated with help-seeking
	The Common Sense Model of self-regulation of health and illness also informed the intervention, for example, visual and verbal information was designed to shift cognitive and emotional representations of cancer.	
What		
3. Materials	<ul style="list-style-type: none"> • PowerPoint presentation including information on what is cancer, teenage and young adult cancer statistics, common teenage and young adult cancers, early warning signs of cancer, importance of knowing your body, talking about cancer, cancer treatment, smoking, sun safety, alcohol, physical activity, diet and Teenage Cancer Trust. • Three video clips of 36 s, 1 of 4 min 38 s, and 1 of 4 min 51 s in duration. • Paper-based homework exercise for completion with parents/carers at the end of intervention delivery. 	
4. Procedures	<ul style="list-style-type: none"> • PowerPoint slides are delivered in lecture style by the intervention provider with group interaction and discussion facilitated by posing questions to adolescents. • Each video clip is played in its entirety at appropriate points during the presentation and preceded by an introduction to video content by the intervention provider and followed by group discussion. • The paper-based homework exercise is distributed to adolescents at the end of intervention delivery by the intervention provider, preceded by instructions for its completion. 	
Who provided		
5. Intervention provider	Paid educator employed by Teenage Cancer Trust with 3.5 years' experience (at point of study commencement) of delivering the unmodified intervention to adolescents with previous professional experience in health promotion.	
How		
6. Mode of delivery	Face-to-face delivery to adolescents in mixed-gender groups of between 80 and 314.	
Where		
7. Location of delivery	Assembly hall or 'street' area in 10 state secondary schools in the Glasgow City Council local authority area in Scotland, UK.	
When and how much		
8. Time	Delivered to adolescents on a single day once in each intervention school over a 15-day period in September 2013. Intervention was 50 min in duration, depending on duration of timetabled class period. Adolescents absent from school on the day of intervention delivery were not offered the intervention on an alternative date.	
Tailoring		
9. Planned adaptations	Intervention was not tailored for specific groups of adolescents, although less or more time was devoted to discussion to accommodate different class period duration in schools.	
Modifications		
10. Unplanned alterations	No modifications were made to the intervention after trial commencement.	
How well		
11. Planned	The same intervention provider delivered the intervention in all 10 intervention schools.	
12. Actual	Intervention delivery log maintained by intervention provider. Average length of intervention was 35 min for a planned 50-min presentation; only 20% of schools included role-play designed to increase communication self-efficacy, and only 30% were shown a film designed to address help-seeking barriers.	

cancer') using a 5-point Likert scale ranging from strongly disagree to strongly agree.

Outcome assessment was conducted at baseline, 2-week follow-up and 6-month follow-up in the classroom.

Socio-demographic characteristics

Socio-demographic questions were included to gather data on age, gender and ethnicity. Students were also asked to tick 'Yes' or 'No' to the following question: 'Have you, you family or close friends had cancer?' If they answered 'Yes', then they were asked to indicate who had had cancer, for example, family member or friend.

Unintended consequences

One potential unintended consequence of adolescent cancer education may be heightened anxiety. Anxiety was therefore assessed using the Hospital Anxiety and Depression Scale [23,24].

Intervention fidelity

The Teenage Cancer Trust educator kept a record of which components of the intervention she delivered and length of time for each component.

Intervention contamination

At the end of the study, head teachers of all schools were asked whether their school over the previous 12 months had invited other speakers to talk about cancer, fundraised for a cancer charity, had a member of staff or student diagnosed with cancer, invited other speakers to discuss a health issue or fundraised for a health charity.

Sample size

Sample size calculation was based on a cluster size of 10 schools with an average of 100 12-/13-year-olds in each school, with a power of 90% and a two-sided alpha of 0.05. Our previous pilot study showed a difference of 2.7 cancer warning signs recognised between control and intervention groups [6]. Assuming an intraclass correlation coefficient of 0.05, a sample size of 10 schools (1000 adolescents) would have a 90% power to detect a difference of 0.5 cancer warning signs between the intervention and control groups. Actual intraclass correlation coefficient calculations for the number of cancer warning signs recognised (primary outcome) were 0.03 at 2-week follow-up and 0.038 at 6-month follow-up.

Randomisation

Recruited schools were defined as high and low deprivation by their score on the Scottish Index of Multiple Deprivation [25]. Because of the skewed deprivation profile of Glasgow, which has high levels of deprivation, Scottish

Index of Multiple Deprivation quintile 1 was coded as high deprivation, with quintiles 2–5 as low deprivation to create two groups. Similarly, schools were grouped as large (≥ 150 registered students aged 12/13) or small (< 150). Schools were grouped by their deprivation and size and randomly allocated within these strata to intervention or control groups. Randomisation was undertaken by the trial statistician in June 2013 using SAS 9.2 (SAS Institute, Cary, NC, USA).

Blinding

Schools were informed of their group allocation following randomisation. The Teenage Cancer Trust presenter was aware of group allocation in order to schedule school visits but was not involved in data collection or analysis. The trial statistician responsible for randomisation also conducted data analysis, alongside a second data analyst who was not involved in randomisation of schools.

Statistical methods

Data were analysed in SAS 9.2. Descriptive statistics were calculated for all variables in the trial. All analyses were conducted as intention to treat on randomised participants with all available data in mixed models [26]. Distributions were tested for normality and logarithmic transformations applied where appropriate. Multiple linear regression was used for all analyses of continuous variables, with baseline measure and intervention allocation included as fixed effects in adjusted models. School was added as random factor to account for cluster effect. Binary variables were analysed using logistic regression with the same model settings. Additional modifying variables to the outcome were age, gender, deprivation score, school size, ethnicity, anxiety score and communicative self-efficacy at baseline. These variables were included in the models if they showed significance on their own but remained only when they achieved statistical significance within the model.

Ethical considerations

Study approval was obtained from the Research Ethics Committee, School of Health Sciences, University of Stirling (reference: 13/14(83)) and Glasgow City Council, Research Unit.

Results

Participant flow

Participant flow is illustrated in Figure 1.

Of 3223 adolescents eligible for inclusion (on the school register), 2173 (67.4%) completed baseline assessment; 1129 (52.0%) were in schools randomised to the intervention group and 1044 (48.0%) in schools randomised

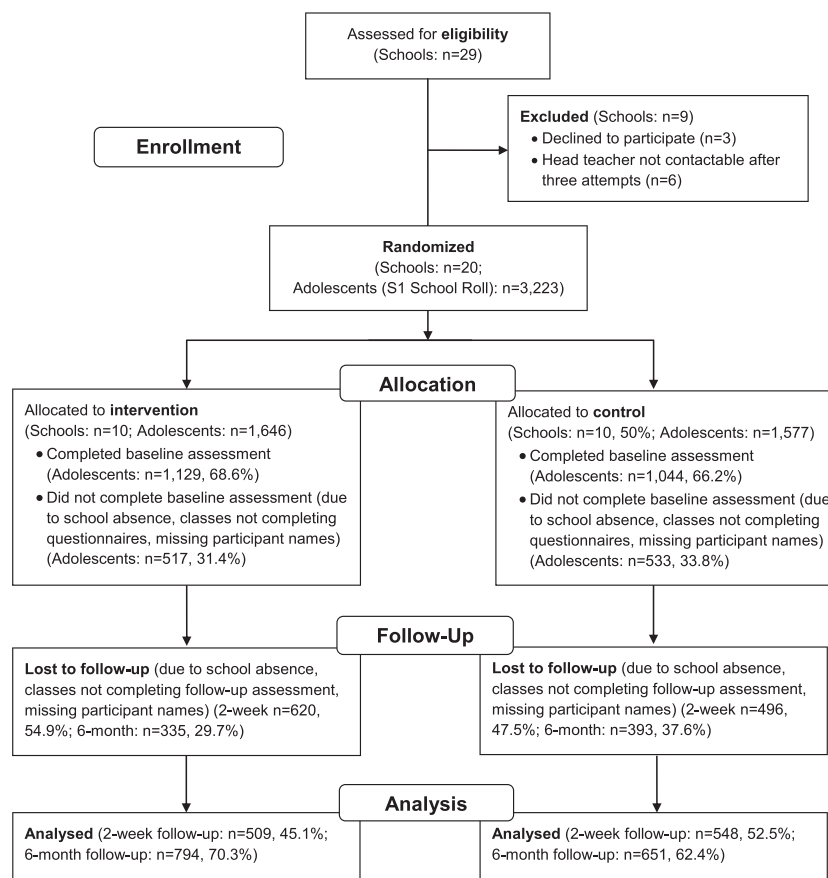


Figure 1. Participant flow

to the control group. Data to assess between-groups differences at 2-week follow-up were available for 1057 (48.6%) adolescents and at 6-month follow-up for 1445 (66.5%) of adolescents; 838 (38.6%) adolescents provided data at all three time points. Reasons for loss to follow-up included student absence from school, classes not completing the survey or participant names missing on questionnaires. The proportion of loss for each of these reasons is not known.

Baseline data

At baseline, the sample included 2173 (female: $n=1102$, 50.7%) adolescents with a mean age of 12.4 years (standard deviation=0.55). Socio-demographic characteristics of respondents are shown in Table 2.

Baseline outcome assessment is reported in Table 3. Briefly, at baseline, adolescents in intervention schools recognised 4.2 (out of 9) cancer warning signs, recognised 4.1 (out of 11) cancer risk factors and endorsed 3.9 (out of 11) barriers to help-seeking, and 9.1% had spoken with someone about cancer in the previous 2 weeks (Table 3).

Effectiveness of intervention

Cancer warning sign awareness

Recognition of all nine cancer warning signs increased 2 weeks after the intervention, and the greatest increases were found for unexplained weight loss (36.2%), change in the appearance of a mole (29.7%) and unexplained pain (19.4%) (Table 4). At 6-month follow-up, recognition was higher than baseline for all cancer warning signs, and the greatest increases were found for unexplained weight loss (17.8%), change in the appearance of a mole (24.4%) and unexplained pain (15.6%) (Table 5). The tables show that recognition of cancer warning signs also increased in control schools. At 2-week and 6-month post-baseline assessments, there was an observed increase for unexplained weight loss of 6.8% and 6%, respectively, and for change in the appearance of a mole, an increase of 9.7% and 10.8%, respectively. Changes in unexplained pain as a cancer warning sign were slightly higher among control schools compared with intervention schools at 6 months (16.3% vs 15.6%).

Table 2. Sample socio-demographic characteristics

	Intervention (n = 1129)		Control (n = 1044)		All (n = 2173)	
	%	(n)	%	(n)	%	(n)
Age						
Mean	12.4		12.5		12.4	
[SD]	[0.49]		[0.60]		[0.55]	
Gender						
Male	48.4	(546)	46.6	(486)	47.5	(1032)
Female	50.8	(573)	50.7	(529)	50.7	(1102)
Missing	0.9	(10)	2.8	(29)	1.8	(39)
Knew someone with cancer						
Yes	58.8	(664)	57.7	(602)	58.3	(1266)
No	34.0	(384)	38.2	(399)	36.0	(783)
Missing	7.2	(81)	4.1	(43)	5.7	(124)
Ethnicity						
White	80.8	(912)	87.5	(914)	84.0	(1826)
BME	18.1	(204)	9.8	(102)	14.1	(306)
Mixed	4.2	(47)	2.7	(28)	3.5	(75)
Asian	8.0	(90)	3.9	(41)	6.0	(131)
Black	3.6	(41)	1.5	(16)	2.6	(57)
Chinese	1.0	(11)	0.4	(4)	0.7	(15)
Other	1.3	(15)	1.2	(13)	1.3	(28)
Missing	1.2	(13)	2.7	(28)	1.9	(41)
Deprivation (SIMD)						
Quintile 1	37.0	(418)	39.6	(413)	38.2	(831)
Quintiles 2–5	63.0	(711)	60.4	(631)	61.8	(1342)
School size						
Small (<150 students)	21.3	(240)	29.6	(309)	25.3	(549)
Large (≥150 students)	78.7	(889)	70.4	(735)	74.7	(1624)
Anxiety (HADS ^a)						
Mean	7.2		7.2		7.2	
[SD]	[4.13]		[4.28]		[4.20]	

BME, Black and Minority Ethnic; HADS, Hospital Anxiety and Depression Scale; SD, standard deviation; SIMD, Scottish Index of Multiple Deprivation.

^aExcluding 266 cases with incomplete anxiety sub-scale data.

In intervention schools, adolescents recognised on average 1.1 more cancer warning signs 2 weeks after the intervention, and this increase was maintained at 6 months. In control schools, recognition increased by 0.7 warning

signs at 2-week follow-up (Table 3). Intervention effect was greater among adolescents who recognised fewer cancer warning signs at baseline. Sub-group analysis found that in intervention schools, recognition increased by 2.3 cancer warning signs at 2-week follow-up among adolescents who recognised <4 cancer warning signs at baseline compared with an increase of 0.7 among adolescents who recognised ≥4 warning signs at baseline. In control schools, a similar pattern was observed with an increase of 1.6 warning signs at 2-week follow-up among adolescents with lower baseline recognition and an increase of 0.1 warning signs among those with higher baseline recognition.

Multiple linear regression models showed a statistically significant difference in the number of cancer warning signs recognised in the intervention group compared with the control group at 2-week and 6-month follow-ups (Table 6). Sensitivity analysis using a repeated-measures test confirmed these findings ($\beta=0.672$, 95% CI 0.322, 1.022; $p < 0.001$).

Cancer risk factor awareness

Recognition of nine (out of 11) cancer risk factors increased 2 weeks after the intervention, and the greatest increases were observed for being overweight (26.0%), getting sunburnt more than once as a child (25.9%) and HPV infection (15.2%) (Table 4). There was no change in recognition of smoking as a cancer risk factor at 2-week follow-up due to ceiling effects at baseline (Table 4), and there was a decrease in the proportion of adolescents agreeing that having a close relative with cancer was a risk factor (7.5%) (Table 4). At 6-month follow-up, recognition was higher than at baseline for seven (out of 11) risk factors, and the greatest increases were found for being overweight (12.8%), getting sunburnt (16.6%) and HPV infection (7.7%) (Table 5).

Adolescents recognised 0.6 more cancer risk factors 2 weeks after the intervention and 0.4 more risk factors at 6-month follow-up. In control schools, recognition

Table 3. Change in outcome measures

Outcome	Intervention						Control					
	Baseline		2-week		6-month		Baseline		2-week		6-month	
	Mean	[SD]	Mean	[SD]	Mean	[SD]	Mean	[SD]	Mean	[SD]	Mean	[SD]
Primary												
Cancer warning signs	4.2	[2.06]	5.3	[2.20]	5.3	[2.36]	3.9	[2.12]	4.6	[2.28]	4.8	[2.48]
Cancer risk factors	4.1	[2.18]	4.7	[2.34]	4.5	[2.46]	3.8	[2.19]	4.0	[2.26]	4.0	[2.34]
Barriers to help-seeking	3.9	[2.46]	3.7	[2.58]	3.6	[2.56]	3.9	[2.48]	3.7	[2.57]	3.6	[2.64]
Secondary												
Cancer communication [% (n)]	9.1	(103)	18.0	(115)	8.5	(94)	8.0	(84)	8.3	(72)	7.5	(78)
Unintended consequences												
Anxiety	7.2	[4.13]	6.7	[4.40]	7.1	[4.48]	7.2	[4.28]	7.1	[4.48]	7.1	[4.39]

SD, standard deviation.

Table 4. Change in cancer symptom and risk factor awareness and endorsement of barriers to help-seeking between baseline and 2-week follow-up

Outcomes	Intervention						Control					
	Baseline		2-week follow-up		Change		Baseline		2-week follow-up		Change	
	%	n	%	n	%	n	%	n	%	n	%	n
Cancer warning signs (Yes)												
Unexplained weight loss	37.9	193	74.1	377	36.2	184	40.3	221	47.1	258	6.8	37
Change in appearance of a mole	43.4	221	73.1	372	29.7	151	43.8	240	53.5	293	9.7	53
Unexplained pain	45.6	232	65.0	331	19.4	99	37.2	204	52.6	288	15.4	84
Cough or hoarseness	33.0	168	45.0	229	12.0	61	31.6	173	43.6	239	12.0	66
Sore that does not heal	26.1	133	37.7	192	11.6	59	22.4	123	31.0	170	8.6	47
Lump or swelling	79.8	406	87.4	445	7.6	39	75.2	412	82.5	452	7.3	40
Difficulty swallowing	30.3	154	36.9	188	6.6	34	30.7	168	38.3	210	7.6	42
Unexplained bleeding	48.1	245	54.0	275	5.9	30	42.3	232	53.6	294	11.3	62
Change in bowel/bladder habits	51.9	264	55.4	282	3.5	18	57.3	314	59.9	328	2.6	14
Cancer risk factors (strongly agree/agree)												
Being overweight	41.0	209	67.0	341	26.0	132	42.2	231	45.1	247	2.9	16
Getting sunburnt as a child	41.0	209	66.9	341	25.9	132	37.6	206	48.9	268	11.3	62
HPV infection	14.5	74	29.7	151	15.2	77	14.9	82	26.6	146	11.7	64
Low levels of physical activity	23.0	117	34.0	173	11.0	56	20.1	110	20.5	112	0.4	2
Being over 70 years old	21.6	110	30.0	153	8.4	43	24.2	133	21.4	117	-2.8	-16
Excess alcohol consumption	40.1	204	48.3	246	8.2	42	40.9	224	43.8	240	2.9	16
Low fruit/vegetable consumption	9.9	50	15.9	81	6.0	31	10.1	55	9.1	50	-1.0	-5
Second-hand smoke	54.8	279	57.8	294	3.0	15	53.7	294	57.6	316	3.9	22
Eating red or processed meat	14.5	74	14.9	76	0.4	2	13.1	72	13.5	74	0.4	2
Smoking	84.1	428	84.1	428	0.0	0	77.0	422	83.7	459	6.7	37
Having a close relative with cancer	33.2	169	25.7	131	-7.5	-38	31.3	171	30.1	165	-1.2	-6
Barriers to help-seeking (Yes)												
Emotional												
Worried about what the doctor might find	70.3	358	68.2	347	-2.1	-11	70.6	387	65.5	359	-5.1	-28
Too scared	56.4	287	52.2	266	-4.2	-21	55.1	302	51.1	280	-4.0	-22
Too embarrassed	45.6	232	52.2	266	6.6	34	42.5	233	42.1	231	-0.4	-2
Not confident to talk about symptoms	50.8	259	42.7	217	-8.1	-42	44.9	246	39.3	215	-5.6	-31
Practical												
Too busy	15.2	77	16.0	81	0.8	4	19.5	107	17.3	95	-2.2	-12
Other things to worry about	16.2	82	14.7	75	-1.5	-7	19.1	105	19.9	109	0.8	4
Difficult to arrange transport	13.6	69	10.5	53	-3.1	-16	14.9	82	10.4	57	-4.5	-25
Service												
Difficult to make an appointment	20.6	105	20.8	106	0.2	1	20.4	112	16.4	90	-4.0	-22
Worried about wasting the doctor's time	29.0	148	29.3	149	0.3	1	27.0	148	25.0	137	-2.0	-11
Difficult to talk to doctor	29.3	149	30.4	155	1.1	6	29.8	163	26.6	146	-3.2	-17
Family												
I would not want my family to find out	34.4	175	26.4	134	-8.0	-41	33.2	182	31.0	170	-2.2	-12

increased by 0.2 risk factors at 2-week follow-up (Table 3).

Multiple linear regression models showed a statistically significant difference in the number of cancer risk factors recognised in the intervention group compared with the control group at 2-week and 6-month follow-ups (Table 6). Sensitivity analysis using a repeated-measures test confirmed these findings ($\beta=0.751$, 95% CI 0.452, 1.049, $p<0.001$).

Barriers to medical help-seeking

There were decreases in the proportion of adolescents endorsing six (out of 11) barriers to help-seeking 2 weeks

after the intervention, and the greatest decreases were observed for not being confident to talk about symptoms (8.1%), not wanting family to find out (8.0%) and being too scared (4.2%) (Table 4). At 6-month follow-up, endorsement was lower than at baseline for eight (out of 11) barriers to help-seeking, and the greatest decreases were observed for not being confident to talk about symptoms (9.0%), being worried about what the doctor might find (8.5%), not wanting family to find out (7.5%) and being too scared (7.2%) (Table 5).

Endorsement of barriers to help-seeking decreased by 0.2 barriers 2 weeks after the intervention and by 0.3 barriers at 6-month follow-up. A similar pattern was observed in control schools (Table 3).

Table 5. Change in cancer symptom and risk factor awareness and endorsement of barriers to help-seeking between baseline and 6-month follow-up

Outcomes	Intervention						Control					
	Baseline		6-month follow-up		Change		Baseline		6-month follow-up		Change	
	%	n	%	n	%	n	%	n	%	n	%	n
Cancer warning signs (Yes)												
Unexplained weight loss	44.2	351	62.0	492	17.8	141	39.6	258	45.6	297	6.0	39
Change in appearance of a mole	46.3	368	70.7	561	24.4	193	45.6	297	56.4	367	10.8	70
Unexplained pain	48.6	386	64.2	510	15.6	124	38.2	249	54.5	355	16.3	106
Cough or hoarseness	36.3	288	53.0	421	16.7	133	31.6	206	48.1	313	16.5	107
Sore that does not heal	28.6	227	38.0	302	9.4	75	20.9	136	28.4	185	7.5	49
Lump or swelling	81.5	647	88.0	699	6.5	52	75.1	489	83.1	541	8.0	52
Difficulty swallowing	34.8	276	40.4	321	5.6	45	31.6	206	42.5	277	10.9	71
Unexplained bleeding	47.1	374	59.4	472	12.3	98	41.5	270	54.7	356	13.2	86
Change in bowel/bladder habits	54.4	432	62.1	493	7.7	61	57.1	372	60.4	393	3.3	21
Cancer risk factors (strongly agree/agree)												
Being overweight	42.7	339	55.5	441	12.8	102	39.0	254	40.2	262	1.2	8
Getting sunburnt as a child	41.0	326	57.6	458	16.6	132	37.7	246	41.4	270	3.7	24
HPV infection	16.1	128	23.8	189	7.7	61	14.9	97	29.1	189	14.2	92
Low levels of physical activity	25.5	202	29.1	231	3.6	29	19.1	124	21.8	142	2.7	18
Being over 70 years old	23.2	184	27.2	216	4.0	32	22.6	147	22.1	144	-0.5	-3
Excess alcohol consumption	44.7	355	43.1	342	-1.6	-13	38.4	250	40.1	261	1.7	11
Low fruit/vegetable consumption	13.6	108	11.8	94	-1.8	-14	9.6	62	7.7	50	-1.9	-12
Second-hand smoke	59.1	469	62.1	493	3.0	24	54.6	356	58.7	382	4.1	26
Eating red or processed meat	16.1	128	15.7	124	-0.4	-4	12.8	83	10.7	70	-2.1	-13
Smoking	83.1	660	84.6	672	1.5	12	77.1	502	79.2	516	2.1	14
Having a close relative with cancer	34.4	273	32.7	259	-1.7	-14	29.6	193	39.0	254	9.4	61
Barriers to help-seeking (yes)												
Emotional												
Worried about what the doctor might find	69.8	554	61.3	487	-8.5	-67	68.5	446	64.6	421	-3.9	-25
Too scared	54.9	436	47.7	379	-7.2	-57	55.7	363	51.5	335	-4.2	-28
Too embarrassed	44.3	352	45.3	359	1.0	7	43.8	285	42.3	275	-1.5	-10
Not confident to talk about symptoms	48.3	383	39.3	312	-9.0	-71	44.8	292	34.5	225	-10.3	-67
Practical												
Too busy	18.7	149	17.9	142	-0.8	-7	18.8	122	14.3	93	-4.5	-29
Other things to worry about	16.7	133	19.2	152	2.5	19	19.4	126	16.9	110	-2.5	-16
Difficult to arrange transport	12.5	99	8.9	70	-3.6	-29	13.7	89	8.8	57	-4.9	-32
Service												
Difficult to make an appointment	21.2	169	18.5	147	-2.7	-22	20.4	133	17.6	114	-2.8	-19
Worried about wasting the doctor's time	27.5	219	29.2	232	1.7	13	26.6	173	26.4	172	-0.2	-1
Difficult to talk to doctor	26.9	213	25.3	201	-1.6	-12	28.6	186	23.4	152	-5.2	-34
Family												
I would not want my family to find out	33.9	269	26.4	210	-7.5	-59	33.3	217	25.9	169	-7.4	-48

No statistically significant differences between intervention and control groups were found for endorsement of barriers to medical help-seeking (Table 6).

Cancer communication

The proportion of adolescents in intervention schools who reported speaking to someone about cancer in the past 2 weeks increased from 9.1% at baseline to 18.0% at 2-week follow-up and was 8.5% at 6-month follow-up. At 2-week follow-up, there was a small increase (0.3%) in the proportion of adolescents in control schools who reported cancer communication in the previous 2 weeks and a decrease (0.5%) at 6-month follow-up (Table 3).

Logistic regression models showed that adolescents in intervention schools were 2.7 times more likely to discuss

cancer at 2-week follow-up compared with the control group at 2-week follow-up (Table 7). There was no statistically significant difference between intervention and control groups at 6-month follow-up (Table 7). Communication self-efficacy was not statistically significantly associated with cancer communication at either time point in univariate tests ($p=0.910$ and $p=0.328$, respectively) and therefore was not included as a mediator in the final logistic regression model.

Unintended consequences (anxiety)

Adolescents' anxiety score decreased by 0.5 in intervention schools at 2-week follow-up and by 0.1 at 6-month follow-up. In control schools, there was no change in anxiety scores at 2-week or 6-month follow-up (Table 3).

Table 6. Adjusted linear regression models for intervention effect on primary outcomes and unintended consequences (anxiety)

Outcome	2-week follow-up				6-month follow-up			
	95% CI				95% CI			
	β	<i>p</i>	Lower	Upper	β	<i>p</i>	Lower	Upper
Cancer warning signs ^a	0.689	<0.001	0.351	1.028	0.471	0.012	0.103	0.838
Cancer risk factors ^b	0.711	<0.001	0.447	0.976	0.277	0.046	0.001	0.550
Barriers to help-seeking ^c	0.269	0.151	−0.098	0.635	0.008	0.964	−0.349	0.365
Anxiety ^d	−0.030	0.915	−0.579	0.519	0.246	0.291	−0.211	0.702

^aAdjusted for number of cancer warning signs recognised at baseline and school.

^bAdjusted for number of cancer risk factors recognised at baseline, knew someone with cancer and school.

^cAdjusted for number of barriers to help-seeking endorsed at baseline, gender, anxiety and school.

^dAdjusted for anxiety score at baseline, gender and school.

Table 7. Adjusted logistic regression model for intervention effect on secondary outcome (cancer communication)

Outcome	2-week follow-up						6-month follow-up					
	95% CI						95% CI					
	β	<i>p</i>	Lower	Upper	Odds ratio		β	<i>p</i>	Lower	Upper	Odds ratio	
Cancer communication ^a	0.992	0.014	0.260	1.725	2.698		−0.068	0.829	−0.803	0.667	0.934	

^aAdjusted for cancer communication at baseline, know someone with cancer, gender, anxiety and school.

No statistically significant differences between intervention and control groups were found for anxiety (Table 6).

Intervention fidelity

All intervention schools received the presentation scheduled for 50 min. The average time for the presentation was 35 min (standard deviation 4.37), which meant that the presenter was not able to deliver all intervention components. The proportion of schools that did not follow protocol is presented in Table 8. Only 20% of schools included role-play designed to improve communication self-efficacy, and only 30% included the film designed to address barriers to help-seeking [20]. These two components had been recently added to the intervention (see section on 'Intervention') and were less familiar to the presenter.

Intervention contamination

Eleven out of 20 schools returned the questionnaire. Only two schools had invited other speakers to talk about cancer, but eight had fundraised for cancer charities, and six had a staff member diagnosed with cancer in the previous 12 months. Nine schools had invited other speakers to talk about health issues, and six had fundraised for a health charity.

Conclusions

Adolescents in intervention schools recognised significantly more cancer warning signs and risk factors than

adolescents in control schools, and cancer communication increased. Some of the percentage increases at 6 months post-intervention compared favourably with evaluations of adult cancer awareness interventions [7,27]. We found smaller but favourable outcomes for the assessment-only control group, which is a reminder that assessment-only conditions may activate change. Moreover, as our study shows, schools engage in fundraising for cancer charities and invite speakers to talk about cancer and other health issues, which may explain why control schools also saw increases in cancer awareness. This study confirms that expectations of the effects of brief interventions need to be modest and realistic.

Schools provide fertile ground for public health campaigns, including cancer awareness. The effects found in our study are similar to the effects of school/college-based brief interventions (<5-h duration) in other health domains such as smoking [28,29] and drug and alcohol use [30–32]. Our study shows that the cancer risk factors most recalled were those most pertinent to this age group (e.g. get sunburnt as a child and HPV). Cancer awareness campaigns may therefore have greater effect if the materials used are age specific to aid retention.

This intervention aimed to alter cognitive representations of cancer. Psycho-educational modalities are typically didactic presentations focusing on providing information and education. This psycho-educational modality may explain the observed changes in the number of cancer warning signs and cancer risk factors recognised by adolescents in our study. Nevertheless, our study shows that increases in cancer awareness at 2 weeks post-intervention

Table 8. Proportion of schools receiving intervention components

Learning objective	Technique	Proportion of schools (%)
Introduction	Verbal information on what the session is going to cover and allow people to leave if they feel uncomfortable	100
Encourage open discussion about cancer	Role-play – young people act out a scenario with person sitting next to them and feed back to speaker	20
Encourage open discussion about cancer	True or false quiz with pupils conferring on the answers	100
Encourage open discussion about cancer	Film clip of talking openly about cancer and explaining why it is important to talk about it	80
What is cancer	Verbal and written information on basic biology of cancer, with pictures of normal and abnormal cells	100
Explanation of why cancer information is important for this age group	Verbal and written information on numbers of young people, and general population, with cancer in the UK and emotions involved with a cancer diagnosis	100
Issues around delays in diagnosis in young people with cancer	Verbal ‘story telling’ of real-life case study; film clip	30
Signs and symptoms of cancer	Film clips of young people describing their symptoms; verbal and written description	100
Types of cancer	Written list and verbal description	100
Information about ways in which to reduce the risk of developing cancer later in life	True or false quiz about: smoking, alcohol, diet, exercise and sun safety	100
How cancer is treated and side effects of treatment	Verbal information on chemotherapy, radiotherapy and surgery	60
Information about Teenage Cancer Trust	Film and verbal information about what the charity does to help young people with cancer	60 – verbal only no film
Recap key facts and challenge young people to tell family what they have learned	Parent–adolescent homework activity sheet	Recap = 60; challenge = 90

were not retained to the same extent at 6 months. This suggests that public cancer awareness interventions across the life course may be required to maintain the effects of school-based programmes.

The study shows no significant differences in the number of barriers to help-seeking endorsed by adolescents in intervention and control schools. The intervention’s short film where a teenager with cancer talks about her experiences of diagnosis and a GP encourages young people to visit the doctor if they are worried about cancer was intended as a key component. However, because only 30% of schools were shown the film, this may explain why the intervention was not effective in reducing the number of barriers to help-seeking. This highlights the importance of assessing intervention fidelity to interpret findings. An alternative explanation, however, is that this brief intervention did not offer sufficient dosage to impact help-seeking. Studies about other health issues have also highlighted the limited effect of psycho-educational modalities [33,34]. Thus, different modalities – or possibly more intensive psycho-educational interventions – should be tested to see if they address barriers to help-seeking about cancer during adolescence.

The intervention was designed to increase cancer communication because being able to talk about cancer is a determinant of medical help-seeking [14]. During the intervention, there was a request for adolescents to talk to each other about cancer; however, only 20% of schools had this role-play component of the intervention delivered. These interactive elements of the intervention

were designed to improve the performance of talking about cancer following Bandura’s social cognitive theory [35]. We therefore hypothesised that baseline communication self-efficacy, as well as positive or negative changes in baseline communication self-efficacy at follow-up, would mediate the outcome of cancer communication. Although the intervention was effective in increasing cancer communication, baseline communication self-efficacy was not associated with this outcome and neither did communication self-efficacy change as a result of the intervention. The observed increases in cancer communication therefore cannot be attributed to communication self-efficacy. The study suggests that while the brief psycho-educational interventions increase cancer communication, self-efficacy does not mediate this relationship.

Strength and limitations

A cluster RCT is one of the most robust methods for examining cause–effect relationships [36]. A protocol was published [20], and a detailed *a priori* analysis plan was written. The trial, however, has a number of limitations. First, our results may not be generalisable. The 20 participating schools may have been particularly committed to improving cancer awareness because of the very recent changes to the Scottish national ‘Curriculum for Excellence’ that includes ‘health and well-being’ as a strand of the curriculum [37]. Second, our follow-up period was only 6 months. Hence, we do not know if a school-based psycho-educational brief intervention can

sustain significant long-term effects on cancer awareness. The intervention covers signs and symptoms of all cancers including those that typically occur in older age, and adolescents may have forgotten all that they have learnt by the time they reach older age. The question remains: What is the likely long-term benefit of raising adolescent cancer awareness? It is premature therefore to draw any conclusions regarding the long-term effects of school-based brief interventions. Moreover, until we know if there are any long-term benefits, the intervention should perhaps focus on cancers that are more common during adolescence. Third, intervention fidelity was compromised, which means that the effect of the intervention if it were to be delivered as planned may be better than reported in this paper. Conversely, the findings reported here reflect the outcomes of an intervention delivered in real-world as opposed to laboratory settings and so probably reflect what can be achieved in real-world settings. Finally, the study is unable to show if these modest increases in cancer awareness and cancer communication are cost-effective and clinically significant, that is, whether they impact early diagnosis and survival during

adolescence and across the life course as risk of cancer increases.

Implications for practice

School-based brief psycho-educational interventions are easy to deliver, require very little resource and have a modest effect on cancer awareness. More intensive psycho-educational interventions or use of different modalities may be required to address help-seeking barriers, and interventions that are age relevant may be more effective. It is premature to draw any conclusions about lasting effects on public cancer awareness or, indeed, whether these changes impact timeliness to diagnosis.

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